

AMENDMENTS TO THE CLAIMS

Claim 1 (Currently amended): An implantable, temporospatially dynamic, rachiorthotic orthopaedics device comprising:

a ~~unidirectional force generating means~~ spring for generating a unidirectional force which acts over a range of deflection of said ~~unidirectional force generating means~~ spring;

a first attachment means for attaching said ~~unidirectional force generating means~~ spring to a first vertebra; and

a second attachment means for attaching said ~~unidirectional force generating means~~ spring to a second vertebra;

wherein

said unidirectional force is applied by said ~~unidirectional force generating means~~ spring via said first and second attachment means to said first and second vertebrae such that said first vertebra and said second vertebra are urged, over a period of time (which period of time extends beyond the end of a medical procedure to implant said orthopaedics device) and over a range of rotational, axial and/or flexional/extensional motion, towards a predetermined desired spatial relationship with respect to one another,

said unidirectional force is generated by setting said spring in tension or compression between first and second attachment points during the course of implantation,

at least one of said first and second attachment means comprises unidirectional gripping means which allow motion of said spring in relation to said attachment means in one axial direction of said spring, but prevent such motion in the opposite axial direction of said spring, wherein said tension or compression is achieved through pushing or pulling said spring through said unidirectional gripping means, and

whereby, over said period of time, said unidirectional force urges a proprioceptively neutral position of said first and second vertebrae towards a desired neutral position, and whereby a biological correction of a spinal deformity, spinal injury or other spinal disorder may be mechanically facilitated.

Claim 2 (Cancelled)

Claim 3 (Currently amended): An orthopaedics device according to claim 1 in which the magnitude of said unidirectional force is in the range of 0N to 200N.

Claim 4 (Original): An orthopaedics device according to claim 1 in which at least one of said first and second attachment means comprises a mobile joint chosen from the group consisting of a ball-and-socket joint or a hinge joint or a saddle joint or a pivot joint or a gliding joint or a condyloid joint.

Claim 5 (Currently amended): An orthopaedics device according to claim 1 in which at least one of said first and second attachment means comprises:

a base plate for fixation to a vertebra; and

a connecting means for attaching said ~~unidirectional force generating means~~ spring to said base plate,

wherein said base plate is formed such that said connecting means can be connected at various locations on said base plate.

Claim 6 (Currently amended): An orthopaedics device according to claim 1 in which at least one of said first and second attachment means comprises a plate for fixation to a vertebra, which plate comprises a plurality of connecting means for attaching said ~~unidirectional force generating means~~ spring to said plate at a variety of locations on said plate.

Claim 7 (Currently amended): An orthopaedics device according to either of claim 5 or claim 6 ~~in dependence on claim 4 in which,~~ in which at least one of said first and second attachment means comprises a mobile joint chosen from the group consisting of a ball-and-socket joint or a hinge joint or a saddle joint or a pivot joint or a gliding joint or a condyloid joint, and in which said mobile joint is provided by an interface between said unidirectional force generating means and said connecting means.

Claim 8 (Currently amended): An orthopaedics device according to claim 1 in which said ~~unidirectional force generating means~~ spring is at least partially formed out of a biocompatible, superelastic shape memory alloy, such as a Ni-Ti shape memory alloy.

Claim 9 (Cancelled)

Claim 10 (Currently amended): An orthopaedics device according to claim 1 9 in which said spring is a conventional, coiled spring which generates said unidirectional force by the application of torsional deformation perpendicularly on a coil or a plurality of coils in the coiled spring.

Claim 11 (Currently amended): An orthopaedics device according to claim 1 9 in which said spring is a bending spring which generates said unidirectional force by the application of bending moments on curves of the bending spring.

Claim 12 (Original): An orthopaedics device according to claim 11 in which said bending spring comprises a length of elastic or super-elastic material shaped into a least one C- or S-shaped curve at at least one point along its length.

Claim 13 (Cancelled)

Claim 14 (Currently amended): An orthopaedics device according to claim 1 13 in which a plurality of said springs are provided such that the setting of the magnitude of said unidirectional force is achieved by appropriate pre- or intra-operative selection of a spring from said plurality of springs.

Claim 15 (Currently amended): An orthopaedics device according to claim 1 13 in which at least one of said first and second attachment means comprises releasable clamping means for releasably clamping said spring to said first and/or said second attachment means, wherein said tension or compression is achieved through i) releasing said releasable clamping means, ii) mechanically applying said tension or compression and iii) clamping said releasable clamping means.

Claim 16 (Cancelled)

Claim 17 (Currently amended): An orthopaedics device according to claim 1 ~~43~~ in which said spring is at least partially formed out of a biocompatible, superelastic shape memory alloy, such as a Ni-Ti shape memory alloy wherein said setting of said spring in tension or compression is achieved through a martensitic or austenitic transformation in the shape memory alloy section of the spring due to a difference between the pre-operative temperature of said spring and the intra- and/or post-operative temperature of said spring.

Claim 18 (Currently amended): An orthopaedics device according to claim 1 in which said ~~unidirectional force generating means~~ spring is arranged such that said unidirectional force drops to substantially zero in the proximity of a position at which said first and second vertebrae attain said predetermined desired spatial relationship.

Claim 19 (Currently amended): An orthopaedics device according to claim 1 in which said unidirectional force generating means is shaped either at manufacture or intraoperatively to substantially conform to the shape of the portions of the surfaces of said first and second vertebrae over which said ~~unidirectional force generating means~~ spring passes.

Claim 20 (Currently amended): An implantable, temporospatially dynamic, rachiorthotic orthopaedics system comprising:

a plurality of orthopaedics devices ~~according to any of the preceding claims, each of the orthopaedics devices including~~

a spring for generating a unidirectional force which acts over a range of deflection of said spring;

first attachment means for attaching said spring to a first vertebra; and

a second attachment means for attaching said spring to a second vertebra;

wherein

said unidirectional force is applied by said spring via said first and second attachment means to said first and second vertebrae such that said first vertebra and said second vertebra are urged, over a period of time (which period of time extends beyond the end of a medical procedure to implant said orthopaedics device) and over a range of rotational, axial and/or

flexional/extensional motion, towards a predetermined desired spatial relationship with respect to one another,

said unidirectional force is generated by setting said spring in tension or compression between first and second attachment points during the course of implantation,

at least one of said first and second attachment means comprises unidirectional gripping means which allow motion of said spring in relation to said attachment means in one axial direction of said spring, but prevent such motion in the opposite axial direction of said spring, wherein said tension or compression is achieved through pushing or pulling said spring through said unidirectional gripping means, and

the orientation of the ~~unidirectional force generating means~~ spring of one of said plurality of orthopaedics devices may be set independently of the setting of the orientation of the ~~unidirectional force generating means~~ spring of at least one other of said plurality of orthopaedics devices,

whereby, over said period of time, said unidirectional force urges a proprioceptively neutral position of said first and second vertebrae towards a desired neutral position, and whereby a biological correction of a spinal deformity, spinal injury or other spinal disorder may be mechanically facilitated.

Claim 21 (Currently amended): ~~An implantable, hybrid static/dynamic rachiorthotic orthopedies system comprising an orthopaedics~~ A system according to claim 20, further comprising at least one rod and a rod or rods which may be attached in the place of at least one of said ~~unidirectional force generating means~~ springs by using at least part of said attachment means, whereby a choice may be made pre- and/or intra-operatively for each motion segment which is to be treated whether to apply static or dynamic methods.

Claim 22 (Currently amended): ~~An orthopaedic implantation kit comprising an orthopaedics device according to claim 1, or a system according to claim 20 and further comprising pre-operative planning means including comprising of computer software which suggests appropriate orientation(s), points of attachment and/or forces(s) for said unidirectional force generating means~~ spring.

Claim 23 (Currently amended): An orthopaedics device ~~orthopaedic implantation kit~~ according to claim 22 in which said computer software utilises a finite element model of the spine in generating said suggestions.

Claim 24 (Currently amended): An orthopaedics device ~~orthopaedic implantation kit~~ according to claim 22 in which said computer software utilises data gathered from a digitised X-ray of vertebrae which are to be treated.

Claim 25 (New): A system according to claim 20, wherein the orthopaedics devices include at least one fusion device and at least one non-fusion device.

Claim 26 (New): An implantable, temporospatially dynamic, rachiorthotic orthopaedics device comprising:

a unidirectional force generating means for generating a unidirectional force which acts over a range of deflection of said unidirectional force generating means;

a first attachment means for attaching said unidirectional force generating means to a first vertebra; and

a second attachment means for attaching said unidirectional force generating means to a second vertebra;

in which at least one of said first and second attachment means includes

a base plate for fixation to a vertebra; and

a connecting means for attaching said unidirectional force generating means to said base plate,

said base plate being formed such that said connecting means can be connected at various locations on said base plate, and

at least one of said first and second attachment means includes a mobile joint chosen from the group consisting of a ball-and-socket joint or a hinge joint or a saddle joint or a pivot joint or a gliding joint or a condyloid joint, and in which said mobile joint is provided by an interface between said unidirectional force generating means and said connecting means,

and wherein

said unidirectional force is applied by said unidirectional force generating means via said first and second attachment means to said first and second vertebrae such that said first vertebra and said second vertebra are urged, over a period of time (which period of time extends beyond the end of a medical procedure to implant said orthopaedics device) and over a range of rotational, axial and/or flexional/extensional motion, towards a predetermined desired spatial relationship with respect to one another,

whereby, over said period of time, said unidirectional force urges a proprioceptively neutral position of said first and second vertebrae towards a desired neutral position, and whereby a biological correction of a spinal deformity, spinal injury or other spinal disorder may be mechanically facilitated.

Claim 27 (New): An orthopaedics device according to claim 26, wherein said unidirectional force generating means is adapted to exert a force obliquely between the first attachment means and the second attachment means.

Claim 28 (New): An implantable, temporospatially dynamic, rachiorthotic orthopaedics device comprising:

a unidirectional force generating means for generating a unidirectional force which acts over a range of deflection of said unidirectional force generating means;

a first attachment means for attaching said unidirectional force generating means to a first vertebra; and

a second attachment means for attaching said unidirectional force generating means to a second vertebra;

in which at least one of said first and second attachment means includes a plate for fixation to a vertebra, the plate having a plurality of connecting means for attaching said unidirectional force generating means to the plate at a variety of locations thereon, and

at least one of said first and second attachment means includes a mobile joint chosen from the group consisting of a ball-and-socket joint or a hinge joint or a saddle joint or a pivot joint or a gliding joint or a condyloid joint, and in which said mobile joint is provided by an interface between said unidirectional force generating means and said connecting means,

and wherein

said unidirectional force is applied by said unidirectional force generating means via said first and second attachment means to said first and second vertebrae such that said first vertebra and said second vertebra are urged, over a period of time (which period of time extends beyond the end of a medical procedure to implant said orthopaedics device) and over a range of rotational, axial and/or flexional/extensional motion, towards a predetermined desired spatial relationship with respect to one another,

whereby, over said period of time, said unidirectional force urges a proprioceptively neutral position of said first and second vertebrae towards a desired neutral position, and whereby a biological correction of a spinal deformity, spinal injury or other spinal disorder may be mechanically facilitated.

Claim 29 (New): An orthopaedics device according to claim 28, wherein said unidirectional force generating means is adapted to exert a force obliquely between the first attachment means and the second attachment means.